I claim:

1. A method for selectively binding a neutral, positively-charged, or negatively-charged molecule, in solution or in the solid state, said method comprising contacting the molecule with a compound comprising a porphyrin macrocycle, and further comprising one or more carboranyl groups that are linked to the porphyrin macrocycle by carbon-carbon bonding.

2. A method as recited in Claim 1, wherein the compound comprises a pentacoordinated or hexacoordinated metal ion at the core of the porphyrin macrocycle.

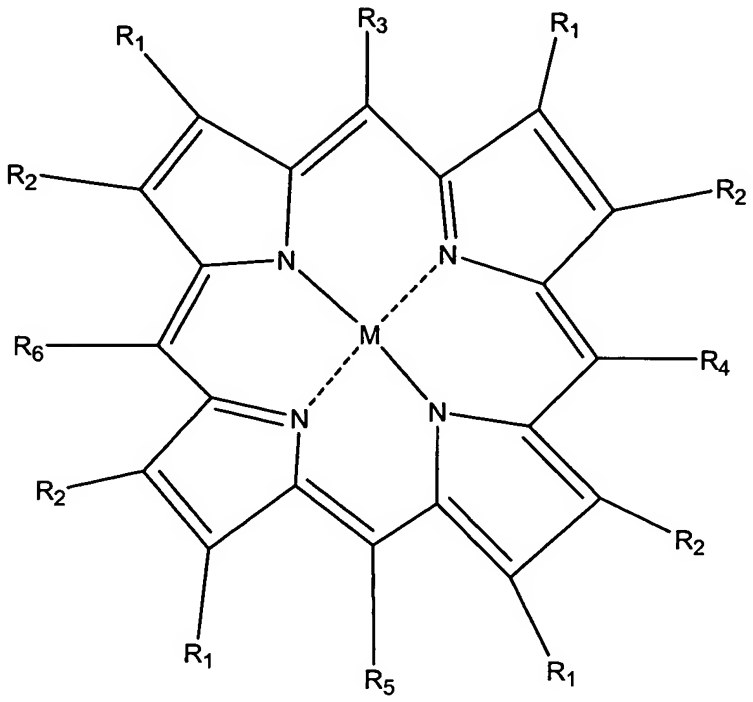
3. A method as recited in Claim 1, wherein the compound comprises a zinc(II), iron(III), manganese(III), aluminum(III), or tin(IV) ion at the core of the porphyrin macrocycle.

4. A method as recited in Claim 1, wherein the compound comprises one or more negatively-charged *nido*-carborane groups bound to the periphery of the porphyrin macrocycle.

5. A method as recited in Claim 1, wherein the compound comprises one or more *closo*-carborane groups bound to the periphery of the porphyrin macrocycle.

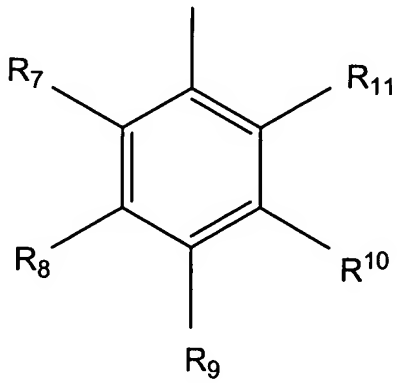
6. A method as recited in Claim 1, wherein the core of the porphyrin macrocycle is positively charged or protonated.

7. A method as recited in Claim 1, wherein the compound has structure **I**:



I

wherein M is 2H or a pentacoordinated or hexacoordinated metal ion; R1 and R2 are each independently hydrogen, C_1 to C_4 alkyl or hydroxyalkyl; and R3, R4, R5, and R6 are each independently hydrogen, phenyl, or substituted phenyl having structure **II**:



II

wherein R7, R8, R9, R10, and R11 are independently hydrogen or a carboranyl group, wherein such a carboranyl group is linked to the phenyl group by a carbon-carbon bond; and wherein one or two of R7, R8, R9, R10, and R11 are hydrogen or such a carboranyl group; and

wherein at least one of R3, R4, R5, and R6 is a substituted phenyl having structure II and having at least one such a carboranyl group.

8. A method as recited in Claim 7, wherein at least two of R3, R4, R5, and R6 are substituted phenyls having structure **II** and each having at least one such carboranyl group.

9. A method as recited in Claim 7, wherein each of R3, R4, R5, and R6 is a substituted phenyl having structure **II** and each having at least one such carboranyl group.

10. A method as recited in Claim 7, wherein at least two of R3, R4, R5, and R6 are substituted phenyls having structure **II** and each having at least one such *nido*-carboranyl group.

11. A method as recited in Claim 7, wherein each of R3, R4, R5, and R6 is a substituted phenyl having structure **II** and each having at least one such *closo*-carboranyl group.

12. A method as recited in Claim 7, wherein at least two of R3, R4, R5, and R6 are substituted phenyls having structure **II** and each having at least one such carboranyl group at R7 or R11.

13. A method as recited in Claim 7, wherein each of R3, R4, R5, and R6 is a substituted phenyl having structure **II** and each having at least one such carboranyl group at R7 or R11.

14. A method as recited in Claim 7, wherein at least two of R3, R4, R5, and R6 are substituted phenyls having structure **II** and each having at least one such carboranyl group at R8 or R10.

15. A method as recited in Claim 7, wherein each of R3, R4, R5, and R6 is a substituted phenyl having structure **II** and each having at least one such carboranyl group at R8 or R10.

16. A method as recited in Claim 7, wherein at least two of R3, R4, R5, and R6 are substituted phenyls having structure **II** and each having at least one such carboranyl group at R9.

17. A method as recited in Claim 7, wherein each of R3, R4, R5, and R6 is a substituted phenyl having structure **II** and each having at least one such carboranyl group at R9.

18. A method as recited in Claim 1, wherein the compound is selected from the group consisting of compounds **3**, **4**, **5**, **6**, **9**, **10**, **11**, **12**, **15**, **16**, **17**, **18**, **23**, **24**, **28**, **29**, **30**, **31**, **33**, **34**, **35**, and **36**.